# FARMERS' SATISFACTION WITH AQUACULTURE

# – A LOGISTIC MODEL IN VIETNAM

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## Abstract

*Aquaculture has been an important economic sector in Vietnam due to its rapid growth and considerable contribution to national fisheries production. With data collected from a field survey interviewing 120 fish farmers in southern Vietnam, this study uses a cumulative logistic model to extend the satisfaction approach to an analysis of the farmers' satisfaction with their fish farming. Regression results show that relative income, not absolute income from aquaculture, has enhanced job satisfaction of the farmers with their fish production. Farmer satisfaction with fish culture is also estimated to increase with their age, their involvement in extension services, larger relative pond surface, and a higher expectation of earnings from aquaculture.*



Key words: job satisfaction, fish culture, small scale farmer, sustainable development, logistic model.

## Introduction

Satisfaction has been studied by many psychologists and sociologists prior to research on its determinants by economists since the 1990 decade (Frey and Stutzer, 2002). Researchers have usually used interchangeably the terms happiness, subjective well-being, satisfaction, utility, and even welfare (Easterline, 2001, Moro et al. 2008). The satisfaction approach has also been applied in research on environmental and ecological economics (Welsch, 2007, Moro et al. 2008). According to Flores and Sarandón (2004), farmer satisfaction is considered an important indicator of sustainability which has become the leading target of scientific research and policy agenda (Ridaura et al. 2002). Contributing to enhancement of life satisfaction (Molnar, 1985, Coughehour and Swanson, 1992), work satisfaction of farmers is a useful determinant of their overall satisfaction (Kalleberg and Loscocco, 1983).

Referring to "an overall effective orientation on the part of individuals toward work roles which they are presently occupying" (Kelleberg, 1977), job satisfaction has been popularly studied (Bitsch and Hogberg, 2005). Consistent with the theory of job satisfaction by Kelleberg (1977), Coughehour and Swanson (1988) found that satisfaction with farming was associated with farmers' perceptions of the economic and noneconomic rewards of farming. In a study in Alabama (USA), Molnar (1985) affirmed that net farm income was a more important determinant of farmers' satisfaction with farming than was total household income.

Farmer satisfaction has also been discussed in research in sectors of forestry, livestock and fisheries. For instance, Kusel and Fortmann (1991) and Kusel (2001) discussed the well-being of forest-dependent farmers and Marker et al. (2005) evaluated satisfaction of livestock farmers with their guarding dogs. In the fishery sector, besides studies on satisfaction of anglers in the United States by Holland and Ditton (1992) and Spencer and Spangler (1992), the relationship between job satisfaction with aspects of fishing work and individual characteristics was examined by Apostle et al (1985), Pollnac and Poggie (2006) and Pollnac et al. (2001). Pomeroy et al. (2006) also mentioned on farmers' satisfaction with aquaculture of live reef organisms in tropical near-shore waters of 11 developing countries of the Indo-Pacific region.

According to Frankic and Hershner (2003) global aquaculture has been increasing rapidly, approximately 10 - 15% per year in the last decade. In developing countries, aquaculture production has been growing about 10% per year since the 1970s (FAO 2002). Aquaculture has been considered an important economic sector in Vietnam due to its rapid growth and its 30 - 40% contribution to total national fisheries production (FAO and NACA, 1997). In addition, seafood is one of the major exports of Vietnam. Alongside fish capture, aquaculture revenue constituted 4% of the Vietnamese GDP in 2003 and made up an export value of $2.35 billion in 2004 (FAO, 2005), or 10% of the country's total export revenue of the year. Aquaculture is in prospect for a rapid development in the country because the total aquaculture area is only 902,229 hectares and because the country has two million hectares of potential water surface (FICEN, 2005), covering 3 % of the country's land area.

The development of aquaculture is now helping Vietnam in various ways by contributing to the national budget with exported aquatic products or by improving rural farmers' livelihoods. Income contribution of aquaculture development programs to farmers' livelihoods in the country have been discussed by Duc (2002), Edwards et al. (2002), and Luu et al. (2002). In a previous analysis on economic contribution of aquaculture to farm income, Duc (2008) also mentioned farmers' satisfaction with rural aquaculture in southeast Vietnam. However, all of the preceding studies have yet to apply an appropriate econometric method for a rigorous research of the role of aquaculture in fish farmers' satisfaction. This study extends the satisfaction approach to a logistic analysis to examine determinants of farmer satisfaction with their fish culture. The study also contributes to literature on the role of aquaculture in farmers' livelihoods and sustainable development. Furthermore, the micro data related to the job satisfaction are less likely available in a developing country like Vietnam. The dataset collected in the survey used for this study is unique so far.

## Research Methods

### *Survey description*

The data for this study is from a field survey conducted in 2001 with 120 fish farmers in three provinces of Binh Phuoc, Tay Ninh and Long An in southern Vietnam. The investigated region is also the target area of an aquaculture development program, the UAF-Aqua Outreach Program (UAF-AOP), which was implemented in 1995 under a cooperation of provincial extension agencies and fisheries faculty of the University of Agriculture and Forestry (UAF, recently Nong Lam University, Hochiminh City). Because of poor resources due to dry soil and water deficiency as well as remote distances to urban regions, aquaculture was underdeveloped in the provinces prior to the program launch (Duc, 2002). Poor farmers lived mainly on subsistence agriculture and off-farm work with temporary jobs. Aquaculture, therefore, was adopted as a good option for rural development and the improvement of farmer livelihoods (Duc, 2008). This enterprise has been continuously growing in both land area and production intensity, mostly within extensive and semi-extensive aquaculture systems.

According to Sen (1985, cited by Kusel, 2001), individual well-being goes along with opportunities or capacities and achievements or successes in light of available opportunities. The implementation of the UAF-AOP was a great opportunity for the farmers' involvement in aquaculture. For small-scale farmers, pond areas are small, ranging from 40 to 9,000 $m^2$, and the ratio of pond surface to farm size ranges from 0.25 – 80 % while the land area occupied by surveyed households ranges from 500 to 120,000 $m^2$. Nevertheless, irrespective of the economic or other benefits of large-scale aquaculture operations, greater emphasis is placed on small-scale farming in developing countries (Edwards et al., 1996). According to Pillay (1990), this is largely because of the opportunities it offers for part- and full-time employment, which helps to sustain peasants and fishermen in rural areas, reducing the drift of populations to urban centers.

To get the levels of the farmers' satisfaction with fish culture, the respondents were asked the question "*Do you feel completely satisfied with integrating fish culture into your farming?*" The farmers' responses to the above question are based on the Likert scale, ranging from 1 ("strongly agree") to 5 ("strongly disagree"). Frequencies of the responses are summarized in Table 1.

Headed mostly by men, the surveyed households had an average size of five members, ranging from one to sixteen, and a median number of two men, while the ages of the respondents (also household heads) ranged from 26 to 80, with a mean of 47, mostly concentrated in the range of 35 - 60. The respondents had quite high education levels, with more than 75% of them having completed secondary or higher levels. The high educational level of the farmers should make them more willing to adopt new farming technologies, thereby improving their livelihoods.

***Income measures***

Farmers who earn higher incomes are likely more satisfied because they have more opportunities to get what they desire (Molnar, 1985, Frey and Stutzer, 2002). Household income includes farming income, off-farm income, non-farm income, and also income from wild fish capture, which plays an important role in the livelihoods of the target farmers (Duc, 2002, Nho and Gutman, 1999). Household income is divided by household size to get per capita income.

Farming income includes incomes from farming enterprises, such as rice cultivation, livestock raising, fish culture, non-rice crop farming and fruit trees, all of which contribute to farmers' annual income. Any enterprises practiced solely for consumption that do not contribute to a farmer's income are ignored in this study because farmers do not consider them as sources of income and because their role in farmers' livelihoods is empirically irrelevant.

All income measures are net income values following the Enterprise Budgeting method (Jolly and Clonts, 1993). With the method, during the investigation year some farmers received "negative" income, meaning that calculated variable cost exceeded the respective revenue they earned. To make relative income from fish culture more precise and because "negative" income figures are less than 1,000 USD in absolute values, the household income, farming income, and income from fish culture (called "fish income" in brief) are added to 1,000 to calculate the ratios of fish income to household income and farming income.

***Cumulative logistic model***

Consistent with Campbell (1981) and Chamberlain (1985), Frey and Stutzer (2002) suggest a micro-econometric function to measure satisfaction, $W_{it} = \alpha + \beta X_{it} + \varepsilon_{it}$ where $W_{it}$ is level of satisfaction, $X_{it}$ is a vector of explanatory variables of demographic and socioeconomic characteristics, $\alpha$ is intercept and $\beta$ is a vector of parameters respective to the explanatory variable X. A cumulative logistic model is estimated in SAS software to explore aquaculture related determinants of fish farmers' satisfaction with the enterprise.

Agresti (2002) defines the cumulative probabilities in a simpler form

$$\text{logit}[P(Y \le j \mid X)] = p_1(X) + \ldots + p_j(X) \qquad \text{(Equation 1)}$$

where j = 1, … , J – 1, represents the category of response and J is the number of categories of responses. Y is the response of $i^{th}$ respondent and X is a vector of explanatory variables.

The cumulative logits are written as follow

$$\mathrm{logit}[P(Y \le j \mid X)] = \frac{\log P[(Y \le j \mid X)]}{1 - \log p[(Y \le j \mid X)]} \qquad \text{(Equation 2)}$$

A logistic model that simultaneously uses all cumulative logits is given by

$$\mathrm{logit}[P(Y \le j \mid X)] = \alpha_j + X_i^{'}\beta \qquad \text{(Equation 3)}$$

where X' is the transpose of X.

Each cumulative logit has its own intercept $\alpha_j$ increasing in *j,* but the same coefficient $\beta$ for each explanatory variable, representing the effect of the explanatory variable on the response Y. The response curves for *j* have the same shape determined by $\beta$. They share exactly the same rate of increase or decrease but are horizontally displaced from each other. According to Agresti (2002), for fixed *j*, the response curve is a logistic regression curve for a binary response with outcomes $Y \le j$ and $Y > j$.

For a cumulative logistic model estimating farmers' satisfaction with fish culture, the first explanatory variable included is fish yield which is defined as fish production divided by pond area. When fish yield increases, the satisfaction with fish culture is expected to increase. Demographic characteristics, such as ages and education levels of the respondents, are also included as control variables in the model, as suggested by Frey and Stutzer (2002) and Coughenour and Swanson (1992). Per capita income is included in the model to control for the effect of different levels of income on satisfaction from fish culture. In the target area, fish culture has contributed to an increase in household income of small scale farmers (Duc 2008).

Due to the capital constraint involved with fish culture (Duc, 2002), higher income farmers are expected to be more likely to gain satisfaction with fish culture.

Molnar (1985) believes that satisfaction with farming is positively related to net farm income and that farm income is a more important determinant of satisfaction with farming than is total household income. The absolute income from fish culture and its incomes relative to total household income and to farming income are major interest variables in the model and can be used to explore the effect of earnings from fish culture on the farmers' satisfaction with this enterprise. The number of men in a household represents possible effects of male labor on fish income, leading to possible effects on the farmers' satisfaction.

Land area is also considered in the analysis because of its important role in the small scale farmers' livelihoods (Quan, 1998), and higher land area is expected to increase satisfaction with fish culture, assuming that farmers would expand fish culture as their satisfaction increases. On the other hand, for small scale farmers who have land as the only material resource invested in their production, the ratio of pond area to total land area defines the scale of fish culture and thus the household's involvement in fish farming. Michalos (1991) and Inglehart (1990), cited by Easterline (2001), state that "individual well-being is determined by the gap between aspiration and achievement". Thus, another explanatory variable included in the model is farmers' expectation, which is measured by the gap of farmers' estimate of contribution of fish farming to household income in percentage and the real value calculated from production data. Farmers' involvement in extension services offered by the UAF-AOP is also included in the model to explore the role of extension in the farmers' satisfaction. Descriptive statistics of variables are summarized in Table 2, and the cumulative logistic model for the farmers' satisfaction with fish culture is specified as follows

*Logit[P(satisfy ≤ j)] = f(yield, income, fish-farmincome, fish_hhincome, fishincome, age, edulevel, men, land, pond-land, involve, expectation)* Model (1)

where *satisfy* is a categorical variable for farmer satisfaction with fish culture and *j* represents for values of the Likert scale, representing five levels of satisfaction from "strongly satisfied" to "strongly dissatisfied."

The intercepts in the regressed logistic models indicate increasing levels of farmer satisfaction (scaling scores), i.e. probability of each level of the satisfaction (*satisfy* ≤ *j*), given explanatory variables, increases in *j* and the logit as an increasing function of this probability. Interaction between variables is also examined to explore the effects of age, expectation and involvement in extension on the other variables.

The cumulative logit of satisfaction from fish culture is

$$\text{logit}\,[\text{P}\,(\text{satisfy} \leq 2)] = \log \frac{\text{P}(\text{satisfy} \leq 2)}{\text{P}(\text{satisfy} > 2)} = \log \frac{\text{P}(\text{satisfy} \leq 2)}{1 - \text{P}(\text{satisfy} \leq 2)}$$

The estimated probability of the farmers' satisfaction from fish culture is

$$\text{P}(\text{satisfaction}) = \text{P}\,(\text{satisfy} \leq 2) = \frac{\exp\{\text{logit}[\text{P}(\text{satisfy} \leq 2)]\}}{1 + \exp\{\text{logit}[\text{P}(\text{satisfy} \leq 2)]\}}$$

The Statistical Analysis Software (SAS) logistic regression procedure with backward selection is used, setting a maximum P-value of 10%. Only variables having significant effects are kept in the model, insignificant ones were dropped out by the backward selection. With response from a farmer in the Likert scale from 1 to 5, representing the responses from "strongly agree" to "strongly disagree,'' the fixed threshold j = 2 exhibits farmer satisfaction with his (her) fish farming. At j = 2, the response curve is a logistic regression curve for a binary response with outcomes Y ≤ *2* and Y > *2,* and we can get the estimated cumulative probability *p* of farmers' satisfaction or happiness to calculate marginal effects of continuous explanatory variables. For dummy variables (say, D), marginal effects are differences between $P(Y \leq 2 \mid D=0$, given other variables) and $P(Y \leq 2 \mid D=1$, given other variables). Estimates and marginal effects of explanatory variables are presented in Table 4. Elasticities, which measure satisfaction effects in percentages of continuous explanatory variables such as fish income and pond area, are also calculated from the marginal effects based on Hensher and Johnson's (1981) formulation.

## Regression Results and Discussion

The proportional odds test ($\chi^2 = 21.3560$, P = 0.4988) confirms that regressed parameters are the same across logits, simultaneously for all predictors, affirming that the cumulative logistic model is relevant to explore the effect of aquaculture-related determinants on the dependent variable (probability of farmer satisfaction with fish culture). The Chi-square tests for Goodness-of-fit of the model (Table 3) justify that the regression results are significant ($P<0.001$). The logistic model (Table 4) for farmers' satisfaction with aquaculture can be written as follows

$$\text{Logit}[P(\textit{satisfy} \leq 2)] = -2.2659 + 1.8626\ \textit{fish-farminc} + 1.2231\ \textit{age} + 0.0616\ \textit{pond\_land} + 0.0642\ \textit{pond-land*age} + 2.3381\ \textit{involve} + 0.1387\ \textit{expectation} - 0.0795\ \textit{age*expectation} - 0.0030\ \textit{pond\_land*expectation} - 2.1587\ \textit{edulevel*involve} + \varepsilon$$

### *Effects of economic rewards from fish culture*

Coughehour and Swanson (1988) found that satisfaction with farming was associated with farmers' perceptions of the economic rewards of farming. Rewarded values from fish culture in this analysis include income measures and fish yields. Unexpectedly, neither per capita income nor fish income in absolute measures has a significant effect on farmers' satisfaction with fish culture, as their effects were eliminated under backward selection of the model regression. Because per capita income is total household income divided by number of household members, the insignificance of per capita income is consistent with prior findings of Molnar (1985), Coughenour and Tweeten (1986), and Coughehour and Swanson (1992) as they argue that income of farm families increasingly is derived from non-farm sources. Their argument would also be appropriate for the investigated area of southern Vietnam, the most dynamic economic region of the country with a rapid growth of manufacturing industry that is employing more labor from rural areas. Furthermore, for the poor with a limited resource, cash income appears to have a more significant role in their lives compared to other income measures and the economic contribution of fish culture was relatively small compared to other commercial non-rice crops and non-farm income (Duc, 2008).

The fact that the result of fish income in its absolute measure has no significant effect in the model can be explained by a prior research by Frank (2005) in which he argued that the absolute income growth of recent decades has failed to create corresponding increases in measured well-being. He suggested that if income affects individual satisfaction, it is relative, not absolute, income that matters. The reason is similar for the insignificant satisfaction effect of fish yield, another economic value rewarded from aquaculture because wild fish still play a very important role in creating cash income for the farmers living in the investigated area (Duc, 2002, Nho and Gutman, 1999) and farmed fish are more popular for household consumption among the targeted small scale farmers (Duc 2008). Therefore, fish yield has yet to create a significant influence on the farmers' satisfaction.

In contrast to absolute income, relative income from fish culture is shown to have a significant effect on the farmers' satisfaction. Consistent with Frank's (2005) suggestion, regression results of this study show that the estimated probability of farmers' satisfaction increases with higher fish income relative to farming income. The probability of farmers' satisfaction with fish culture is estimated to increase by 20.1% when their relative income from fish culture doubles.

***Effect of pond area relative to farm size***

The insignificant coefficient of *land* variable (and thus the variable was dropped out of the final model by the backward selection in regression procedure) exhibits no relationship between farmers' satisfaction and their farm size. This result is consistent with previous findings of Coughenour and Tweeten (1986), Mooney (1988), and Coughenour and Swanson (1992). However, the significant coefficient of *pond_land* exhibits a positive relationship between job satisfaction of fish farmers and their pond area relative to farm size. Elasticity of the farmers' job satisfaction in respect to the ratio between pond surface and farm size is calculated to be 0.073, showing that a doubling in the pond area relative to farm size of fish farmers raises their estimated probability of job satisfaction by 7.3%. The significant positive coefficient of interaction between *pond_land* and *age* suggests that a larger pond surface relative to farm size appears to increase the satisfaction probability with fish farming among older farmers. A doubling in relative pond area of the older farmers is estimated to increase their probability of satisfaction with fish culture by 5.4%.

***Effects of farmers' ages and education levels***

The effect of age is significant in the model, with the marginal satisfaction of age being 0.15; the older farmers achieve higher probability of satisfaction to fish culture estimated at the significant level of 90%. This result is consistent with the previous finding of Kalleberg and

Loscocco (1983) and Coughenour and Tweeten (1986) when they justified that age is positively related to job satisfaction.

The positive relationship between education level of farmers and their satisfaction with farming suggested by Molnar (1985) is not confirmed statistically in the logistic model. The negative coefficient of interaction between education level and involvement in extension service suggests that the better educated farmers who are involved in extension services feel less satisfaction with their fish culture. Such a negative relationship between education level and farmers' satisfaction with their farming was reported by Coughenour and Swanson (1992). The regression result, in other words, also suggests that the less educated farmers involved in extension services would get more satisfaction from their fish farming activities. Generally, without the role of extension services, better educated farmers are more satisfied with their fish culture. The role of extension services in the farmers' satisfaction is reaffirmed in remote areas where the poorer farmers, due to their limitations in financial capacity, are less able than the richer farmers to get formal education.

***Role of extension services***

The role of extension services in farmers' satisfaction with fish farming is confirmed as the logistic regression results show that farmers involved in extension activities have a higher satisfaction with fish farming, which may be a positive consequence derived from the higher income and higher expectation that they gain from this enterprise, although the income has no explicit effect on the satisfaction. That is because fish culture has been demonstrated to raise incomes of the poor in the investigated area and hopefully alleviate their poverty (Duc, 2008).

### *Farmers' expectation and their satisfaction with fish culture*

Expectations of earnings from fish culture also contribute to the farmers' satisfaction with fish culture. This scenario seems not to support the discussion of Frey and Stutzer (2002) who argue that "wants are insatiable", the more a person gets, the more he (she) wants, and higher expectation leads to less satisfaction. Their argument is possibly appropriate for the older farmers as the negative coefficient of interaction between *age* and *expectation* shows that the older farmers with higher expectations of earnings from fish culture would depress their satisfaction with the enterprise. The negative coefficient, in other words, exhibits that the younger farmers with higher expectations of their fish earnings from fish culture get higher satisfaction probability with the enterprise than do the older farmers. This statement appears to support a prior finding of Coughehour and Swanson (1992) that an optimistic attitude of farmers about farming determines their satisfaction with farming.

The argument of Frey and Stutzer (2002) is also appropriate for farmers whose ponds have reached their limits because with a small yet negative marginal effect of interaction (-0.0004) between relative pond area and the farmers' expectations, the positive effect of relative pond area on farmers' satisfaction narrows a bit for the farmers who have higher expectations of earnings from fish culture. Nevertheless, the positive marginal effect (0.0162) of the variable *expectation* shows that farmers' expectations of earnings form fish culture have a positive overall effect on their satisfaction with the enterprise. Consistent with the findings of Molnar (1985) and Coughehour and Swanson (1992), the farmers with higher expectations can maximize their use of limited resources to pursue fish farming, resulting in more production and higher income get from the enterprise.

## Conclusion

Although income per capita has no significant effect on farmers' satisfaction to fish culture, the logistic model shows that income from fish culture relative to farming income raises the cumulative probability of farmer's satisfaction to fish culture. This result demonstrates that relative income, not absolute income, is associated with job satisfaction. The higher satisfaction is expressed by the farmers who are involved in extension services, who have higher expectations of earnings from fish culture and who have larger pond surface relative to total land area. The older farmers appear to gain a higher probability of satisfaction with fish culture than the younger farmers do. A higher age of farmers increases the positive effect of the relative pond area but lowers the positive effect of higher level of their expectation to the enterprise. Further studies should be conducted in larger survey scales to examine the role of education, extension involvement, and economic rewards from aquaculture in creating farmer satisfaction.

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Table 1. Frequencies of Dependent Response Variables

| | Level | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| Farmers' satisfaction | 1 – *strongly satisfied* | 25 | 20.83 | 20.83 |
| with aquaculture | 2 – *satisfied* | 74 | 61.67 | 82.5 |
| (*satisfy*) | 3 – *undecided* | 19 | 15.83 | 98.33 |
| | 4 – *dissatisfied* | 2 | 1.67 | 100 |
| | 5 – *strongly dissatisfied* | 0 | 0 | 100 |

Table 2. Summary of Data Description

| Variable (unit) | Description | Mean | S.E. | Min. | Max. |
|---|---|---|---|---|---|
| *Yield* ($kg/m^2$) | yield of fish culture | 0.58 | 0.57 | 0.02 | 3.33 |
| *Hhsize (person)* | household size | 5.017 | 0.17 | 1 | 16 |
| *Men (number)* | number of men in household | 2.39 | 0.09 | 0 | 5 |
| *Land* ($m^2$) | total occupied land area | 14,660.42 | 1,734.05 | 500 | 120,000 |
| *Pond/land (%)* | pond area relative to land | 12.94 | 1.46 | 0.24 | 80 |
| *Hhincome ($)* | total household income | 1215.30 | 85.69 | -637.93 | 5043.10 |
| *Farmincome ($)* | farming income | 686.91 | 70.20 | -1051.72 | 5043.10 |
| *Fishincome ($)* | income from fish culture | 304.55 | 44.56 | 14.48 | 4172.41 |
| *Fish-hhincome (%)* | fish income relative to total household income | 27.76 | 2.33 | 1.40 | 100 |
| *Fish-farmincome (%)* | fish income relative to farming income | 46.95 | 6.33 | -579.69 | 215.38 |
| *Income ($)* | per capita income | 260.61 | 20.20 | -159.48 | 1425.69 |
| *Expectation (%)* | expectation of fish earnings | 15.72 | 1.69 | -8.00 | 75.86 |
| *Age (year)* | ages of respondents | 47.52 | 0.97 | 26 | 80 |
| *Edulevel* | education levels of respondents; *edulevel* = 1 for who completed primary school, *edulevel* = 0 otherwise. | | | | |
| *Involve* | Farmer involvement in extension; *involve* = 1 for those involved in extension services; *involve* = 0 otherwise. | | | | |

Table 3. Results of Statistical Tests for Model Appropriateness and Goodness-of-fit

| Test | Chi-square | P-value |
|---|---|---|
| Proportional Odds Assumption | 21.3560 | 0.4988 |
| Likelihood Ratio | 42.6762 | <0.0001 |
| Score | 36.4359 | 0.0001 |
| Wald | 31.8111 | 0.0008 |

Table 4. Estimates and Marginal Effects of Variables on Farmers' Satisfaction from Aquaculture

| | Estimate | | | Marginal effect | |
|---|---|---|---|---|---|
| Parameter | Coef. | Std. Error | Pr>Chi-sq | Weight average | Std.Error |
| *Intercept1* | -6.2185 | 1.2781 | 0.0001 | - | - |
| *Intercept2* | -2.2659** | 1.098 | 0.0390 | - | - |
| *Intercept3* | 0.5158 | 1.2447 | 0.6786 | - | - |
| *Age* | 1.2231* | 0.6944 | 0.0782 | 0.1500 | 0.1569 |
| *age*pond_land* | 0.0642** | 0.0301 | 0.0329 | 0.0075 | 0.0053 |
| *age*expectation* | -0.0795*** | 0.0297 | 0.0074 | -0.0795 | 0.0297 |
| *Edulevel* | 0.4164 | 0.5091 | 0.4135 | - | - |
| *pond_land* | 0.0616** | 0.0272 | 0.0233 | 0.0072 | 0.0051 |
| *Expectation* | 0.1387*** | 0.0335 | 0.0001 | 0.0162 | 0.0115 |
| *pond_land*expectation* | -0.0030*** | 0.00087 | 0.0005 | -0.0004 | 0.0003 |
| *Involve* | 2.3381** | 0.9999 | 0.0194 | 0.0203 | 0.1795 |
| *edulevel*involve* | -2.1587* | 1.2277 | 0.0787 | -0.2027 | 0.1334 |
| *fish_farmincome* | 1.8626* | 0.9848 | 0.0586 | 0.2176 | 0.1546 |

**, ** and ***: significant at 90%, 95% and 99% level; Model rescaled* $R^2 = 0.35$